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(54) DATA TRANSMITTER, TRANSPORT STREAM GENERATOR AND DATA STREAM GENERATION METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To output a data stream at a rate that is close to its sending rate.

SOLUTION: A video encoder 110 encodes the input video data with compression to generate video streams and an audio encoder 120 encodes the input audio data with compression to generate audio streams. A multiplexer 160 sequentially multiplexes the elementary streams of encoder 110 or 120 and outputs them to a multiplexer 170. A CPU 151 decides the sequence of elementary streams to be multiplexed and the quantity of multiplexing data of each elementary stream, etc., according to the data sizes, etc., notified from data size interfaces 131 and 132, and then controls

multiplexes 160 and 170 according to these decided sequence and data quantity. A multiplexed transport packet is buffered by a FIFO buffer 180 and a transport stream is outputted at a rate approximate to the desired one. Furthermore, a packet space control part 190 performs fine adjustment of the packet space, and a transport stream of a desired output rate is generated.

CLAIMS

[Claim(s)]

[Claim 1]A data sending device which generates a data stream for transmission for transmitting arbitrary transmission object data, comprising:

A packet creating means which generates a predetermined data packet for transmission one by one from said arbitrary transmission object data.

A buffer means which generates a data stream which outputs said data packet one by one at the predetermined intervals, and is constituted by said data packet while memorizing said data packet by which sequential generation was carried out one by one, A buffer control means which controls an output interval of said data packet so that an output rate of said data stream turns into a predetermined output rate decided beforehand.

[Claim 2]As opposed to a data stream to which said buffer control means is sent out from said buffer means, While setting up a sending-out packet interval become the greatest output rate that does not exceed a target output rate which is said predetermined output rate decided beforehand about a actual output rate of said data stream, Difference with the total clock number required when it outputs by the total clock number required when a predetermined data packet group which constitutes said data stream is outputted at said target output rate, and said actual output rate is computed, The data sending device according to claim 1 adding a clock number

equivalent to said difference to one sending-out packet interval of said data packet groups.

[Claim 3]Inside of arbitrary data packets to which said buffer control means belongs to said data packet group, The data sending device according to claim 2 making a packet interval to same number as a clock number equivalent to said difference of data packets increase from a sending-out packet interval clock number set up according to said actual output rate by one clock.

[Claim 4]A transport stream generating device which generates a transport stream for transmitting picture image data and voice data, comprising:

An encoding means which codes the transmission object data of each containing said picture image data and voice data with a prescribed method.

A multiplexing means which generates a transport stream which multiplexes said each coded data in the form of predetermined, and is constituted by transport packet.

A buffer means which outputs said transport packet one by one at the predetermined intervals, and generates a transport stream while memorizing said transport packet one by one.

Said buffer control means which controls an output interval of said transport packet so that an output rate of said transport stream turns into a predetermined output rate decided beforehand.

[Claim 5]Said encoding means codes each data which is said transmission object data with an MPEG2 system (quality dynamic image code-ized method by Moving Picture coding Experts Group), The transport stream generating device according to claim 4, wherein said multiplexing means generates an MPEG2 transport stream which multiplexes said each coded data and is constituted by MPEG 2 transport packet.

[Claim 6]Said buffer control means, A target output rate which is said predetermined output rate decided beforehand about a actual output rate about one from an PCR (Program Clock Reference) packet of a transport stream sent out from said buffer means to an PCR packet. While setting up a sending-out packet interval become the greatest output rate that is not exceeded, A difference clock number equivalent to a time lag of one-frame sending out produced between cases where it outputs by case where it outputs at said target output rate, and said actual output rate is computed, The transport stream generating device according to claim 4 adding said difference clock number to one sending-out packet interval of the transport stream packets sent out to said 1 inter-frame.

[Claim 7]Inside of arbitrary data packets to which said buffer control means belongs to said one frame, The transport stream generating device according to claim 6 making a packet interval to same number as said difference clock number of transport stream packets increase from a sending-out packet interval clock number set up according to said actual output rate by one clock.

[Claim 8]The transport stream generating device comprising according to claim 7:
A control means which said buffer control means computes said difference clock number, and is outputted as fix information text.
A buffer reading control means which controls an output of said buffer means to make a packet interval of a predetermined transport packet increase from a sending-out packet interval clock number set up according to said actual output rate by one clock according to said fix information text.

[Claim 9]Store said control means in free space of said PCR packet, and said fix information text said buffer reading control means, The transport stream generating device according to claim 8 taking out said fix information text from said PCR packet, and controlling an output of said buffer means by predetermined timing.
[Claim 10]In a data stream generation method which generates a data stream for transmission for transmitting arbitrary transmission object data, A predetermined data packet for transmission is generated one by one from said arbitrary transmission object data, Memorize to a buffer said data packet by which sequential generation was carried out one by one, and an output interval of a data packet is controlled so that an output rate of a data stream constituted by said data packet turns into a predetermined output rate decided beforehand, A data stream generation method having a procedure which outputs a data packet memorized by said buffer with said controlled output interval one by one.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention about a data sending device, a transport stream generating device, and its data stream generation method, It is related with the transport stream generating device which generates the transport stream for transmitting the data sending device and picture image data, and voice data which generate the data stream for transmission for transmitting arbitrary transmission object data especially, and its data stream generation method.
[0002]
[Description of the Prior Art]Compression encoding of picture image data and the voice data is carried out in recent years with an MPEG2 system (quality dynamic image code-ized method by Moving Picture codingExperts Group) etc., Digital television broadcasting which is multiplexed to a predetermined transmission packet and distributed to a televiewer is being put in practical use. In such a broadcasting

format, the DVB (Digital Video Broadcasting) standard serves as a de facto standard at present in the digital broadcasting which used MPEG 2 as the base.

[0003]The outline of such a digital-satellite-broadcasting system is explained. Drawing 8 is an outline lineblock diagram of a digital-satellite-broadcasting system. The transmitting side is equipped with the image of the archiver 1 and server 2 grade, and the voice (hereafter referred to as AV) information storing device. The archiver 1 and the AV information from the server 2 are supplied to the coding system 4, after the routing switcher 3 is supplied and switching of AV information is performed. In the coding system 4, while compressing video information and speech information by MPEG 2, respectively and multiplexing them, multiplexing of two or more channels is also performed and a data stream is outputted. The stream from the coding system 4 is supplied to the modulation part 5, for example, a QPSK (Quadrature Phase Shift Keying) modulation part. The abnormal-conditions output from the QPSK modulation part 5 is supplied to the transmission antenna 7 via the up converter (UC) 6, and is transmitted from the transmission antenna 7 to the communications satellite 11. The archiver 1 of a transmitting side system, the server 2, and the coding system 4 are unified by LAN8.

Operation management is carried out by computers 9a, 9b, and 9c combined with LAN8.

[0004]Next, the coding system 4 is explained. Drawing 9 is a coding system lineblock diagram. The same number is given to the same thing as drawing 8, and explanation is omitted. The transport stream generating device (TS GEN) 41-1 which multiplexes picture image data, voice data, etc., 41-2, --, 41-n generate the transport packet for every channel. It multiplexes, after 41-n's inputting picture image data, voice data, and private data (additional data) and coding these by MPEG 2, each transport stream generating device 41-1, 41-2, --,. When coding picture image data, a target coding video rate (for example, rate according to the contents of the program) is given from the computer 9a, and an encoding rate is controlled according to it. The output data of each transport stream generating device 41-1, 41-2, --, 41-n is supplied to the data multiplexing (MUX) part 42. In the data multiplexing part 42, further The EPG (Electronic Program Guide) system for every channel, The information from CA (Conditional Access) system is supplied from EPG-CA43, multiplexes these, and outputs to a QPSK modulation part.

[0005]Each transport stream generating device 41-1, 41-2, --, the transport stream that 41-n generates are explained. Drawing 10 is a timing chart of a transport packet. (a) -- the output interval of a transport packet (TS) -- when fixed, (b) is a timing chart in the case of the ability to tune the output interval of a transport packet finely.

[0006]If it is considered as 204 bytes which added FEC(s) (Forward Error Correction) for the error amendment to 188 bytes of transport packet of packet length etc. and

the clock number of a packet interval is used as N clock, The output rate of a transport stream is 204*8*27/N. It was restricted to the value computed by [Mbps], and was. For example, if a transmission bit rate required for the last target is set to 8.448Mbps, the output rate of a transport stream will serve as 8.4478528Mbps at the time of using as 5216 clocks the packet interval which is a value nearest to 8.448Mbps in private. To transmission rate 8.44Mbps, when the output rates of a transport stream are 8.4478528Mbps, the null packets specified by MPEG are inserted every 11.079 seconds for adjustment of data volume. Although the packet interval of (b) is constant every 16 packets and it has come to be able to do adjustment finely from (a) by specifying the packet number which carries out +1 clock within 16 packets, null packets are inserted every 35.478 seconds even in this case.

[0007]

[Problem(s) to be Solved by the Invention]However, in the conventional transport stream generating device, there is a problem that disorder may arise in the picture reproduced by the receiver by insertion of the null packets which are invalid data.

[0008]Generally, to the modulator connected to the latter part of a transport stream generating device, reference clock PCR (Program Clock Reference) sent to STD for decoders (System Target Decoder) provided in the receiving set is amended. However, the correcting function of PCR is a little complicated, and the modulator without the function is also used partly. If null packets are inserted in a transmission rate to insufficient data volume, without amending PCR, the PCR jitter by the side of decoding increases, and a normal image may not be reproduced.

[0009]When one packet of null packets were inserted and the packet by which PCR multiplex was carried out in this side is outputted, the error for one packet will arise at the maximum. If the transport stream is sent to the decoder of a receiving set, the value of PCR which is a reference signal will have a jitter greatly, and the problem that a picture is confused without the ability to lock normally will occur. Such a phenomenon is actually reported.

[0010]This invention is made in view of such a point, and is a thing.

The purpose is to provide the data sending device which outputs a data stream by the bit rate near **********, a transport stream generating device, and its data stream generation method.

[0011]

[Means for Solving the Problem]In a data sending device which generates a data stream for transmission for transmitting arbitrary transmission object data in order to solve an aforementioned problem in this invention, While remembering said data packet by which sequential generation was carried out to be a packet creating means which generates a predetermined data packet for transmission one by one from said arbitrary transmission object data one by one, A buffer means which generates a data

stream which outputs said data packet one by one at the predetermined intervals, and is constituted by said data packet, Data sending device ** having a buffer control means which controls an output interval of said data packet so that an output rate of said data stream turns into a predetermined output rate decided beforehand is provided.

[0012]In a data sending device of such composition, a packet creating means generates a data packet for transmission one by one from data of a transmission object, and outputs it to a buffer means. A buffer means outputs a data packet one by one at the predetermined intervals according to a buffer control means while memorizing a data packet inputted from a packet creating means one by one one by one. A buffer control means controls a data packet output interval by a buffer means so that a data stream constituted by data packet which a buffer output means outputs serves as a predetermined output rate decided beforehand.

[0013]In a transport stream generating device which generates a transport stream for transmitting picture image data and voice data in order to solve an aforementioned problem, An encoding means which codes the transmission object data of each containing said picture image data and voice data with a prescribed method, While remembering said transport packet to be a multiplexing means which generates a transport stream which multiplexes said each coded data in the form of predetermined, and is constituted by transport packet one by one, A buffer means which outputs said transport packet one by one at the predetermined intervals, and generates a transport stream, Transport stream generating device ** having said buffer control means which controls an output interval of said transport packet so that an output rate of said transport stream turns into a predetermined output rate decided beforehand is provided.

[0014]In such a transport stream generating device of composition, an encoding means codes the transmission object data of each containing picture image data and voice data by a prescribed method, for example, MPEG 2, and outputs it to a multiplexing means. A multiplexing means multiplexes data coded respectively in the form of predetermined, and outputs a transport packet which generated and generated a transport packet to a buffer means one by one. A buffer means outputs a transport packet one by one at the predetermined intervals according to a buffer control means while memorizing a transport packet inputted from a multiplexing means one by one one by one. A buffer control means controls a transport packet output interval by a buffer means so that a transport stream constituted by transport packet which a buffer output means outputs serves as a predetermined output rate decided beforehand.

[0015]In a data stream generation method which generates a data stream for transmission for transmitting arbitrary transmission object data in order to solve an aforementioned problem, A predetermined data packet for transmission is generated

one by one from said arbitrary transmission object data, Memorize to a buffer said data packet by which sequential generation was carried out one by one, and an output interval of a data packet is controlled so that an output rate of a data stream constituted by said data packet turns into a predetermined output rate decided beforehand, Data stream generation method ** having a procedure which outputs a data packet memorized by said buffer with said controlled output interval one by one is provided.

[0016]Such a data stream generation method of a procedure generates a data packet for transmission one by one from data of a transmission object, and outputs it to a buffer. A buffer memorizes a data packet to input one by one, and it controls an output interval of a data packet so that an output rate of a data stream constituted by data packet turns into a predetermined output rate decided beforehand, A data packet memorized by buffer according to a controlled output interval is outputted one by one.

[0017]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described with reference to drawings. Drawing 1 is a lineblock diagram of the transport stream generating device which is the 1 embodiment of this invention.

[0018]The transport stream generating device concerning this invention, Picture image data. The video encoder 110 and voice data to code. The audio encoder 120 and the amount of coding data to code. The data size interfaces 131 and 132 to measure, According to CPU151 and RAM152 for processing which are RAM143 and the control section which are encoder FIFO (First InFirst Out) 141 and 142 and the memory for private data which are buffer memories, RAM153 for control, and a control section, an input terminal. The multiplexers 160 and 170 to choose, FIFO buffer 180 which buffers a multiplexing data stream, the packet interval control section 190 which is the buffer reading control means which control read-out permission of FIFO buffer 180, and private data. It comprises the Ethernet (registered trademark) interface (hereafter referred to as ENIF) 210 and the serial interface (hereafter referred to as SIF) 220 to input. Suppose this transport stream generating device that DBV-Asynchronous Serial I/F (it is hereafter considered as DVB-ASI) which is general asynchronous I/F of DVB-serial is used as an interface of a transport stream.

[0019]The video encoder 110 is an encoding means, carries out compression encoding of the picture image data inputted from the outside with an MPEG2 system, and supplies it to encoder FIFO141 as a video stream.

[0020]The audio encoder 120 is an encoding means, carries out compression encoding of the voice data inputted from the outside with an MPEG2 system, and supplies it to encoder FIFO142 as an audio stream.

[0021]The data size interfaces 131 and 132 calculate the frame of the video stream which the video encoder 110 and the audio encoder 120 output, and an audio stream, or the data size for every field, and notify it to CPU151 via a CPU bus. Since CPU151

grasps the data volume of a private stream, calculation is unnecessary.

[0022]Encoder FIFO141 is a buffer memory, memorizes the inputted video stream one by one, and outputs it to predetermined timing according to control of CPU151. Encoder FIFO142 is a buffer memory, memorizes the inputted audio stream one by one, and outputs it to predetermined timing according to control of CPU151.

[0023]RAM143 for private data memorizes information, including a subtitle, addition audio information, text information, an user datum, etc., and outputs it to the multiplexer 160 as a private stream.

[0024]CPU151 comprises peripheral circuits, such as ROM for a microprocessor and program storing, and it is controlled, for example so that the transport stream generating device operates a request. Specifically, CPU151 supplies a target video coding rate, for example to the bit rate control circuit of the video encoder 110. RAM153 for control memorizes the data for control in connection with processing of CPU151. RAM152 for processing memorizes the data volume dealt with when processing the packet header etc. which were generated. CPU151 generates the contents of the adaptation field including the information on PCR, and the PES (Packetized Elementary Stream) packet header using the control data memorized by RAM153 for control. The generated header is memorized by RAM152 for processing. Based on the data size interfaces 131 and 132, ENIF210, SIF220, the remaining storage capacity of encoder FIFO 141 and 142, etc., CPU151, The turn of the elementary stream to multiplex, the multiplexing data volume of each elementary stream, etc. are determined, and the multiplexers 160 and 170 are controlled based on the determination. Timing adjustment of multiplexing, etc. are performed at this time. The output of a transport stream controls the packet interval control section 190 to approach the transport output rate decided beforehand.

[0025]The multiplexer 160 chooses and multiplexes private the video stream from the input terminal a, the audio stream from the input terminal b, or data stream from the input terminal c according to control of CPU151, and outputs it to the multiplexer 170.

[0026]The multiplexer 170 chooses and multiplexes the header data (TS packet header or a PES packet header) from the elementary stream and the input terminal e from the input terminal d according to control of CPU151, It outputs to FIFO buffer 180 as a transport packet (it is hereafter considered as a TS packet).

[0027]FIFO buffer 180 buffers the TS packet which the multiplexer 170 multiplexed, and outputs it to the multiplexing part (not shown) for multiplexing the stream of two or more channels as a transport stream. That is, the data stream generated with the internal processing clock (for example, 16 MHz) of the device is changed into the output clock (for example, 27 MHz) of an interface, or the output interval of a packet is adjusted, and the transport stream of a desired output rate is outputted. It also has the function which adds an PCR value correctly by the position on DVB-ASI. The transport stream which the multiplexer 170 outputs is outputted to storage devices,

such as a hard disk drive and optical-magnetic disc equipment, and it may be made to record it if needed.

[0028]The packet interval control section 190 controls the timing which starts read-out of the TS packet from FIFO buffer 180 according to CPU151. The packet interval of a TS packet is adjusted by controlling the read timing of FIFO buffer 180.

[0029]ENIF210 accepts the private data 2 inputted via LAN (not shown), such as Ethernet, and outputs it to CPU151 via a CPU bus. SIF220 accepts the private data 1 of serial form inputted, for example from a computer, and outputs it to CPU151 via a CPU bus.

[0030]Operation and the transport stream generation method of the transport stream generating device of such composition are explained. In the transport stream generating device concerning this invention, the video encoder 110 carries out compression encoding of the picture image data to input, generates the video stream of desired data volume, and outputs it to encoder FIFO141. The audio encoder 120 carries out compression encoding of the voice data to input, generates the audio stream of desired data volume, and outputs it to encoder FIFO142. At this time, the data size interfaces 131 and 132 calculate the data size for every frame of each elementary stream outputted from the video encoder 110 and the audio encoder 120, and notify it to CPU151. The video stream and audio stream which were generated are outputted to the multiplexer 160 via encoder FIFO 141 and 142, respectively. RAM143 for private data outputs the private data stream which is attached data to the multiplexer 160. The multiplexer 160 chooses one of elementary streams one by one, multiplexes them, and outputs them to the multiplexer 170. After a header is generated by CPU151 and RAM152 for processing memorizes using the control data memorized by RAM153 for control, or the user datum inputted via ENIF210 or SIF220, it is outputted to the multiplexer 170. The data size which the data size interfaces 131 and 132 notify that CPU151 is, Based on the data size memorized by RAM143 for private data, the data size inputted from ENIF210 or SIF220, etc., The turn of the elementary stream to multiplex, the multiplexing data volume of each elementary stream, etc. are determined, and the multiplexers 160 and 170 are controlled based on the determination. The writing of the TS packet to FIFO buffer 180 is controlled so that it functions appropriately, without FIFO buffer 180 carrying out overflow and underflow and a desired transport stream is outputted at this time. The output of the transport stream outputted from FIFO buffer 180 controls the packet interval control section 190 to approach the transport output rate decided beforehand. Like the above-mentioned explanation, according to control of CPU151, the TS packet multiplexed by the multiplexer 170 is buffered by FIFO buffer 180, and outputs the transport stream in the output rate near a desired output rate. In the packet interval control section 190, a packet interval is tuned finely and the transport stream of a desired output rate is generated.

[0031]Next, a transport stream is explained. Drawing 2 is a lineblock diagram of the transport stream of the transport stream generating device which is the 1 embodiment of this invention.

[0032]This transport stream PAT (Program Association Table) data, PMT (Program Map Table) data, PCR (Program Clock Reference) data, it comprises two or more TS packets for transmitting a coding video stream, a coding audio stream, private data, invalid data (the following and a null -- it is considered as data), etc.

[0033]PAT is information which shows packet identification information PID of the TS packet in which PMT generated for every program is stored. PMT is information the video stream and audio stream which constitute a program indicate packet identification information PID of the TS packet stored, respectively to be. PCR is the information for setting the value of STC (System Time Check) used as a time reference to the timing intended by the encoder side, and comprises 6 bytes of data containing 42 bits of live data.

[0034]The transport stream of such composition is divided into a predetermined number of packets, and is outputted from FIFO buffer 180 as a TS packet to which TS header was added. The transport stream of one video frame is divided into the packet of 107 in the example of the figure. For example, as for the 1st TS packet, a PMT packet and the 3rd are PCR packets a PAT packet and the 2nd. These TS packets are planned for every transport stream of one video frame shown in the figure. An PCR packet is outputted for every video frame.

[0035]The algorithm which outputs the transport stream of the above-mentioned explanation by a predetermined output rate is explained. Drawing 3 is a timing chart of the transport stream which is the 1 embodiment of this invention.

[0036]In DVB-ASI, 27 MHz is used as an output clock, i.e., a read clock of FIFO buffer 180. Packet length makes FEC 204 bytes which added 16 bytes at 188 bytes of TS packet.

[0037]It is a packet interval if the output rate of the target transport stream is set to 8.448000Mbps, [0038]

[Equation 1]

204*8*27/8.448=5215.9091 (clock) .... (1)

It becomes. The output rate at the time of carrying out the 5216 clocks of the packet interval,[0039]

[Equation 2]

204*8*27/5216=8.4478528Mbps .... (2)

The output rate at the time of having come out, being and using a packet interval as 5215 clocks,[0040]

[Equation 3]

204*8*27/5215=8.4494727Mbps .... (3)

It becomes. For this reason, in order to be referred to as 8.448Mbps, it is necessary to

output as a packet interval combining 5215 and 5216.

[0041]Drawing 3 (a) is a figure explaining a principle of a method of setting an output rate to 8.448Mbps. An PCR packet decides to appear for every n packets like TS packet 0 and TS packetn. An PCR value of an PCR packet is theoretically calculated from an output rate of a packet number outputted between PCR packets, and a transport stream, and an PCR packet position on DVB-ASI is corrected so that this may serve as the target value. For example, what is necessary is to output a TS packet with the packet interval 5215, to control one to the following PCR packet of packet intervals to be set to 5215+alpha, and just to adjust them, in order for PCR to serve as the target value. Drawing 3 (a) is adjusting by controlling so that a packet interval of a TS packet (n-1) is set to 5215+alpha. By doing in this way, while the target output rate is obtained, it becomes possible to lessen an PCR jitter at the time of putting on a transmission clock again with a modulator. However, a problem it does not expect it to be that only a specific packet extends an interval depending on a modulator since a packet jitter becomes large momentarily may arise. Then, alpha is distributed to a packet between PCR packets. Drawing 3 (b) is an example which distributed alpha. Here, from a head (PCR packet), +1 clock of the packet interval for alpha packet is carried out, and it is outputted. In this invention, although it is not necessary to restrain to the head side, the following explanation for convenience of explanation is performed as carrying out +1 clock of from a head (PCR packet) to the alpha packet.

[0042]When a maximum bit rate whose output is enabled is set to 52Mbps and a packet number per frame is 625/50 system by which a packet number increases more,

[0043]

[Equation 4]

52 million/(188*8) /25=1382.9787 .... (4)

It becomes. Since PCR is outputted for every frame, a clock number (equivalent to alpha) required to correct the position of an PCR packet is set to a maximum of 1382.

[0044]The calculating method of a correction clock number (alpha) is explained in detail. If packet interval packet_clocks has real number accuracy when a transport stream output rate is expressed with TS_OUT_RATE, [0045]

[Equation 5]

packet_clocks=27 million*204*8/TS_OUT_RATE .... (5)

It becomes. However, when it cuts down to an integer, [0046]

[Equation 6]

packet_clocks_int=floor (27 million*204*8-/TS_OUT_RATE) .... (6)

It is computed. Since packet_clocks_int is narrow compared with packet_clocks when it is in this state, an output rate becomes high a little from a desired value. For this reason, the upvaluation operation was performed in order to consider it as the output rate below a desired value.

[0047]
[Equation 7]
packet_clocks_int=ceil (27 million*204*8-/TS_OUT_RATE) .... (7)
Here, floor(x) is the same as x, or is the maximum integer that does not exceed x, and ceil(x) is the same as x, or means the minimum integer exceeding x.
[0048]Generally, the TS packet was outputted for the packet interval computed by the formula (7) as an interval of the read-out permission from FIFO buffer 180. If the number of TS packets from an PCR packet to the following PCR packet is made into TS_PACKET_NUMBER (fn) and fn is used as a fn position frame, PCR (fn+1) of the PCR value multiplexed to the PCR packet outputted to the following fn+1 frame on the basis of PCR value PCR (fn) by which multiplex was carried out to the PCR packet outputted to a certain fn frame, [0049]
[Equation 8]
TS_OUT_RATE=(TS_PACKET_NUMBER(fn)*8*204)*27000000/(PCR(fn+1)-PCR(fn))
.... (8)
Since it is in ******, [0050]
[Equation 9]
PCR(fn+1)=(TS_PACKET_NUMBER(fn)*8*204)*27000000/TS_OUT_RATE+PCR(fn)
.... (9)
It is calculated. Difference diff_clocks (fn) to PCR (fn+1) at the time of being outputted with the constant interval of packet_clocks_int,[0051]
[Equation 10]
diff_clocks(fn)=TS_PACKET_NUMBER(fn)
*8*204*27000000/TS_OUT_RATE-packet_clocks_int*TS_PACKET_NUMBER(fn)
.... (10)
It becomes. then, an output phase of an PCR packet -- this diff_clocks -- (-- what is necessary will be just to delay by fn) This is equivalent to alpha of the above-mentioned explanation.
[0052]When output rates are 8.448Mbps in 525/60 system, it is at one frame of the beginning, [0053]
[Equation 11]
TS_PACKET_NUMBER(0) =floor(8448000/(204*8) /30) =172 .... (11)
[0054]
[Equation 12]
Packet_clock_int=floor(27 million*204*8/8448000) =5215 .... (12)
[0055]
[Equation 13]
Alpha=diff_clocks (0) =floor(172*8*204*27 million/8448000)-5215*172=156 .... (13)
It becomes. In 525/60 system, although a frame rate is set to 29.97, it is computed as 30 here. When the packet length of a TS packet is 188 bytes, 204 of the

above-mentioned formula is computed by replacing it with 188.
[0056]The output-rate control action and the control method using the correction clock alpha computed by carrying out like the above-mentioned explanation are explained. Drawing 4 is a lineblock diagram of the transport stream generation part of the transport stream generating device which is the 1 embodiment of this invention. The same number is given to the same thing as drawing 1, and explanation is omitted.
[0057]A transport stream generation part of a transport stream generating device concerning this invention, The packet interval control section 190 which comprises CPU151, RAM152 for processing, the multiplexer 170, FIFO buffer 180, and the FIFO lead enabling control means 191 and the PCR packet correcting means 192 is comprised.
[0058]The FIFO lead enabling control means 191 performs data read control from FIFO buffer 180 according to CPU151. The PCR packet correcting means 192 corrects the contents of the PCR packet if needed.
[0059]Operation of a transport stream part of such composition is explained. In a transport stream generation part, 16 MHz of a substrate interface clock is changed into 27 MHz using FIFO buffer 180. Writing to FIFO buffer 180 in the conventional processing is performed by burst processing within a frame from composition of CPU151 and a peripheral circuit, and read-out serves as continuous processing of packet interval regularity. When data volume of a video stream or an audio stream runs short to the bit rate needed at this time, null packets are inserted in order to adjust a rate. CPU151 computes quantity of null packets and null-packets data is written in RAM152 for processing, or RAM143 (not shown) for private data. This inputs into the writing side of FIFO buffer 180. Since a read-out (output) rate of FIFO buffer 180 is correctly computable, the number of null packets inserted is easily computable. For example, since a clock number of 27 MHz of one video frame is 900900 clocks in the case of 525/60 system, when a packet interval is outputted with 1000 clocks,
[0060]
[Equation 14]
900900 / 1000= 900 packet .... (14)
It ******. The value of 900 clocks omitted with less than 1000 clocks is calculated by transferring it to the following frame. 900 omitted clocks are the following frames,
[0061]
[Equation 15]
(900+900900) / 1000= 901 packet .... (15)
It is outputted by carrying out.
[0062]Packets, such as an PCR packet, PAT, PMT, are written in FIFO buffer 180 through RAM152 for processing. Thus, although calculation processing of the number of null packets for every frame is performed from the former, in this invention, the clock number (525/60 900900 and 625/50 1080000) of one frame currently used here

is shortened by the correction clock alpha. Thereby, the calculating method of the conventional number of null packets can be used as it is. +1 clock of the packet interval is carried out for calculated diff_clock (fn). That is, it is used in order to extend the interval of FIFO lead enabling.

[0063]A method of performing adjustment instruction of a packet interval from CPU151 via a CPU interface to the FIFO lead enabling control means 191 is also considered. However, since processing is performed per frame (PCR packet output unit), it is difficult for an PCR packet to measure timing read from FIFO buffer 180 by CPU151. For this reason, fix information text is inserted in an empty data area of an PCR packet as a positive method. Drawing 5 is a lineblock diagram of an PCR packet. (a) shows the usual PCR packet. An PCR packet is filled up with 0xFFH as an empty data area from a top synchronous byte (sync byte) immediately after an PCR extension after the 12th byte. In this invention, fix information text is inserted in free space of this PCR packet in CPU151. (b) is an example of an PCR packet with fix information text. Here, fix information text inserts fix information text in the 12 or 13th byte from a head of free space, i.e., a synchronous byte. Clock correction alpha data, i.e., a packet number which carries out +1 clock of the packet interval, is registered into fix information text. As for this data, top 8 bits and the 13th byte are stored in 8 bits of low ranks for the 12th byte. In order to show that there is fix information text, a synchronous byte of an PCR packet changes into 0xC7H (MSB is reversed) instead of 0x47H, and writes in FIFO buffer 180 through RAM152 for processing.

[0064]Operation and clock regulated treatment of the FIFO lead enabling control means 191 which received such an PCR packet are explained. Drawing 6 is a flow chart of FIFO lead enabling control management of a transport stream generating device which is the 1 embodiment of this invention.

[0065]If a packet interval counter passes the deadline of and reading processing is started (S101), it will be confirmed whether a packet is an PCR packet (S102). If it is not an PCR packet, it will progress to S106. If it is an PCR packet, packet_counter which is a counter of an outputted packet number, and wide_packet_number showing a packet number which extends a packet interval will be initialized to zero (S103). a top synchronous byte (sync byte) -- fix-information-text whereabouts -- it confirms how it is (S104), and, in with fix information text, a packet number which opens the correction clock alpha, i.e., a packet interval, registered into fix information text is set to wide_packet_number (S105). Outputted packet number packet_counter is compared with packet number wide_packet_number which corrects a packet interval (S106), When packet_counter is smaller than wide_packet_counter, a packet interval counter which generates a packet interval is set as packet_clocks_int+1 computed by a formula (7) (S107). When other, a packet interval counter is made into packet_clocks_int (S108). Outputted packet number packet_counter is carried out +1 (S109), and processing is ended (S110), and it waits until a packet interval counter counts up.

[0066]As a result, +1 clock of the packet interval counter is carried out about a packet for wide_packet_number from an PCR packet, and a packet interval becomes large.

[0067]It returns and explains to drawing 4. Thus, when an PCR packet rewritten by CPU151 passes the FIFO lead enabling control means 191, fix information text is incorporated and a packet read-out interval of FIFO buffer 180 is controlled. A corrected PCR packet is returned to original data by the PCR packet correcting means 192.

[0068]A standard (DVB Document A010) of DVB-ASI has two kinds of formats. Drawing 7 is two kinds of formats of DVB-ASI. Although a format shown in (a) has been used in the above-mentioned explanation, it can also respond to (b). In this case, a signal read from a FIFO buffer is realizable by performing **** read-out with a certain clock number for not 1 packet continuation but every clock. It is realizable by providing a FIFO buffer of capacity for one packet after that in an PCR packet correcting means. Considering a point which does not increase circuit structure, the former is effective.

[0069]In the above-mentioned explanation, although a transport stream generating device has been explained, this invention can respond also to a data sending device which generates a data stream by a desired output rate in other asynchronous interfaces.

[0070]The above-mentioned processing capability is realizable by computer. In that case, the contents of processing of a function which a data sending device and a transport stream generating device should have are described to a program recorded on a recording medium which can be read by computer. And the above-mentioned processing is realized by computer by executing this program by computer. As a recording medium which can be read, there are a magnetic recording medium, semiconductor memory, etc. by computer. In circulating a commercial scene, store and circulate a program to portability type recording media, such as CD-ROM (Compact Disc Read Only Memory) and a floppy (registered trademark) disk, or, It stores in a storage device connected via a network, and can also transmit to other computers through a network. When performing by computer, a program is stored in a hard disk drive in a computer, etc., and it loads to main memory and performs.

[0071]

[Effect of the Invention]As explained above, in the data sending device of this invention, the data packet for transmission is generated one by one from the data of a transmission object. The generated data packet is outputted one by one from a buffer with the output interval controlled so that the data stream constituted by the data packet serves as a predetermined output rate decided beforehand, and forms a data stream while it is memorized one by one by the buffer.

[0072]Thus, since the output interval which outputs a data packet is controllable in

detail, addition of the invalid data for adjusting the output rate of a data stream and the necessity for a compensation process called deletion are lost.

[0073]In the transport stream generating device of this invention, the transmission object data of each containing picture image data and voice data is coded in the form of predetermined, and the multiplexed transport packet is generated. A TS packet is outputted one by one from a buffer with the output interval controlled so that the transport stream constituted by the TS packet serves as a predetermined output rate decided beforehand, and forms a transport stream while it is memorized one by one by the buffer.

[0074]thus, the null for adjusting the output rate of a transport stream, since the output interval which outputs a TS packet is controllable in detail -- the necessity for compensation processes, such as addition of data, deletion, and amendment of PCR, is lost. As a result, the cheap modulator which does not have a correcting function in the latter part can be used.

[0075]In the data stream formation method of this invention, the data packet for transmission is generated one by one from the data of a transmission object. The generated data packet is outputted to it one by one from a buffer according to the output interval controlled so that the output rate of the data stream constituted by the data packet turned into a predetermined output rate decided beforehand while it is memorized one by one by the buffer.

[0076]Thus, since the output interval which outputs a data packet is controllable in detail, addition of the invalid data for adjusting the output rate of a data stream and the necessity for a compensation process called deletion are lost.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a lineblock diagram of the transport stream generating device which is the 1 embodiment of this invention.

[Drawing 2]It is a lineblock diagram of the transport stream of the transport stream generating device which is the 1 embodiment of this invention.

[Drawing 3]It is a timing chart of the transport stream which is the 1 embodiment of this invention.

[Drawing 4]It is a lineblock diagram of the transport stream generation part of the transport stream generating device which is the 1 embodiment of this invention.

[Drawing 5]It is a lineblock diagram of an PCR packet.

[Drawing 6]It is a flow chart of the FIFO lead enabling control management of the transport stream generating device which is the 1 embodiment of this invention.

[Drawing 7]They are two kinds of formats of DVB-ASI.

[Drawing 8]It is an outline lineblock diagram of a digital-satellite-broadcasting system.

[Drawing 9]It is a coding system lineblock diagram.

[Drawing 10]It is a timing chart of a transport packet.

[Description of Notations]

110 -- A video encoder, 120 -- An audio encoder, 131, 132 -- Data size interface, 141, 142 -- Encoder FIFO, 143 -- RAM for private data, 151 [-- A multiplexer, 180 / -- A FIFO buffer, 190 / -- A packet interval control section, 210 / -- An Ethernet interface (ENIF) 220 / -- Serial interface (SIF)] -- CPU, 152 -- RAM for processing, 153 -- RAM for control, 160, 170